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ABSTRACT

Based on the principle that safety education should be a vital component in science instruction, this manual was designed to assist elementary teachers in doing more experiments and activities more confidently by making them aware of dangers and precautions. It also aims to make students aware that safety is a lifetime process and responsibility. Contents include: (1) safety checklist for teachers; (2) sample safety procedures (citing first aid and steps); (3) fire prevention and control (reviewing classes of fires and extinguishers and highlighting firefighting techniques); (4) eye and face protection (explaining how to establish an eye protection program); (5) general personal safety (focusing on accident prevention); (6) chemical safety (listing dangerous combinations of common chemicals); (7) heating activities (stating precautionary measures); (8) safety with plants (identifying poisonous plants and symptoms associated with poisoning); (9) biology and life science safety (suggesting guidelines for animal care); (10) home experiments and special projects (providing guidance on extension activities); (11) field trips (containing forms and behavior contracts); (12) rocketry (discussing a safety code); (13) viewing an eclipse (reviewing indirect and safe viewing techniques); (14) references (including sources on general and specific areas of safety); and (15) a teacher feedback form. (ML)

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Elementary Science Safety Manual

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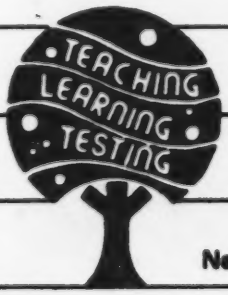

New Jersey Department of Education, Division of General Academic Education

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The Elementary Science Safety Manual

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225 West State Street
CN 500
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1986

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- Revised Edition -

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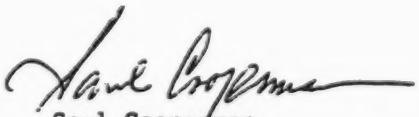
COMMISSIONER'S FOREWORD

Science safety is no accident. It requires knowledge of potential hazards, attention to details, and constant supervision. It is important that the teacher understand the potential dangers of even the simplest of science activities. For example, many common plants cause allergies and the friendliest domestic pets can be potential hazards unless they have all the inoculations.

Planning can eliminate most potential dangers. Activities must be carefully thought out, the unexpected should be anticipated, and preventive procedures should be developed. It is in the areas of understanding hazards and planning precautions that this guide can be most helpful. Designed and assembled by science supervisors and teachers who have observed, experienced or anticipated the dangers, this manual's development has also been strongly supported by the results of the recent assessment of statewide needs in the area of science instruction.

Safety education should be a vital component in science instruction. Demonstrations, hands-on activities and working with live specimens provide the perfect setting for explaining dangers and developing safe practices.

This manual is intended to assist elementary teachers in doing more experiments and activities more confidently by making them cognizant of dangers and precautions. Hands-on activities by students are important at all learning levels but especially at the early school years when children are first forming positive attitudes toward science. It is important to pursue these learning experiences in as safe an environment as possible.



Saul Cooperman
Commissioner

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This manual is based on the early 1960's efforts of Elmer Kruper of the New Jersey Science Teachers Association and his colleagues who strove to establish a guide for safety in the elementary classroom. Throughout the years many educators have sorted, added to, and assembled the document into its current form. The New Jersey State Department of Education wishes to express its appreciation to all those whose efforts and expertise make these materials available to the teachers and administrators of our state. We wish to thank:

Dr. William Burcat
Dr. Thomas Fangman
Dr. Julia Feldman
Ms. Genella Gerardi
Dr. George Gross
Ms. Mary Ann Hull
Mr. Elmer Kruper
Dr. Joseph Krajkovich
Mr. Rex Morrison
Dr. W. G. Perrine
Mr. Donald Peck.

Additionally, thanks are extended to Dr. David Sousa for compiling the manuscript, and to Florence Cucchi for her assistance in editing it.

This elementary safety manual has been produced as a coordinate to the secondary safety manual developed by the New Jersey Science Supervisors Association and the Hoffman-Laroche Company.

REVISED EDITION

Following the distribution of the first edition of this document, the Department of Education carefully tracked the responses of the users. Educators have utilized this manual in their curriculum activities and have passed-on invaluable comments. These comments have been reviewed and are reflected in the corrections, revisions and additions found in the 2nd printing.

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INTRODUCTION

Science is a dynamic, human enterprise that profoundly impacts upon our present culture. Because of this influence, science should be taught at every level of education. Students, if they are to live in an environment that uses science and its technology, must also be taught the nature of scientific enterprise, the basic assumptions, the concepts, and the activities of science. To adequately teach science, a teacher must introduce science concepts and utilize the basic processes which are an essential part of science. These processes include observation, inference, measurement, controlling variables, and they require that students experience hands-on activities with their environment.

Since there is a necessity to sense the environment, there is a corresponding concern for the safety of the students involved in this endeavor. Safety is not a separate unit to be added to the existing science curriculum. Rather, it is a continuing, integral component of science instruction. Teachers of science take on the tasks of teaching students to live safely while learning the concepts and processes of science.

Teachers should attempt to incorporate safety knowledge into their programs. The increasing pace at which knowledge is generated, however, has caused a rethinking of the student's role in safety. Since students exist in an environment which contains innumerable hazards, the ultimate responsibility for their safety is theirs. Science instruction, therefore, should help students recognize a safe environment and suggest actions which will maintain it. The laboratory activity and hands-on approach contribute greatly to this objective.

Students, moreover, must learn of their responsibilities when they are in leadership roles. Careful instruction in science must model responsible actions as well as transmit safety knowledge. This manual serves as a guide to supplement science teaching and safety instruction. Its purpose is not just to make the laboratory and classroom safe, but also to make the student aware that safety is a lifetime process and responsibility.

While every effort has been made to include the latest information on safety, this manual is not intended to cover all possible hazards. Teachers should always review their student activities to determine whether any potential dangers exist.

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SAFETY CHECKLIST FOR TEACHERS

This checklist is presented to assist teachers in preparing safety procedures for the laboratory.

1. ____ Do you brief your students concerning safety procedures prior to each laboratory exercise?

2. ____ Is there a copy of student safety guidelines posted in the lab? Are students familiar with the contents and know how to use it?

3. ____ Have the students received a copy of safety procedures? Are the students required to keep the procedures in their notebooks for easy reference?

4. ____ Are you present at all times when students are working in a classroom or laboratory? Lab work should never be done without supervision.

5. ____ Do you emphasize the importance of traits and attitudes concerning observation, precision, and alertness?

6. ____ Do your students follow a procedure for checking out the laboratory at the end of a class or the school day?

7. ____ Are the students aware that it is unsafe to touch the face, mouth, eyes, and other parts of the body while working in a laboratory situation?

8. ____ Are proper safety measures used when heating a liquid confined in a container?

9. ____ Is everything stored in easily handled, labeled containers? This includes water (tap and distilled) and waste material.

10. ____ Have students obtained <u>all</u> the equipment they will need before beginning lab work?

11. ___ Are commercial spill kits or other materials available to control spills?

12. ____ Do you know where the safety features of this room are located?

13. ____ Have you inspected all glassware for cracks or defects?

14. ____ If glassware is to be heated, do you make sure it is Pyrex?

15. ____ Do students know how to dispose of broken glassware?

16. ____ Do you allow time for students to clean their equipment and area properly?

17. ____ Do you insist that the students wear goggles when heating materials and/or working with chemicals?

18. ____ Do you keep flame far from flammable liquids?

19. ____ Do you and your students wear all necessary protective clothing?

20. ____ Do you insist that students <u>not</u> eat, drink, chew gum, or apply cosmetics in the lab area?

21. ____ Are students thoroughly familiar with the operation of the equipment before they begin the experiment?

22. ____ Have you checked all electrical connections <u>before</u> turning on the current?

23. ____ Have you discussed with all your students their responsibilities in the laboratory?

SAMPLE SAFETY INSTRUCTIONS

The following sample of instructions is provided to assist you in developing or reviewing your own set of instructions.

In Case of Accident

In the event of accident or injury, take the following steps immediately:

1. Notify the school nurse.

2. Notify the school principal.

   A. Immediately obtain medical help by calling a predetermined emergency number, or the police or fire department.

   B. Establish contact with the parents or guardian as soon as possible and urge that they contact their family physician immediately.

   C. If not able to reach parents or guardian, contact the alternate person designated and/or the family physician directly.

First Aid

Each teacher is responsible for knowing how to proceed in the event of a student illness or injury in the classroom.

1. KEEP CALM and keep crowds away from the injured student. Send for school nurse and principal. Handle the person as little as possible until the injury evaluation is complete. Do nothing else unless you are certain of the correct procedures. If corrosive chemicals have contacted the eyes or skin, flush immediately with plenty of water (use eye fountain or shower).

2. RESTORE BREATHING. Restoration may be accomplished by utilizing one of the methods listed below in which you have had sufficient training:

   A. Mouth-to-mouth or mouth-to-nose method.

   B. Cardiopulmonary resuscitation (CPR).

   C. Technique for clearing obstruction of the airway (choking).

3. STOP ANY BLEEDING. If bleeding is severe or profuse, it must be stopped before other aid can be given. Apply a large compress to the wound with direct pressure using the heel of the hand.

4. It is essential to obtain medical aid in every case of serious injury or illness, in all cases of injury to the eye, and whenever in doubt. School employees other than school nurse and doctor should not diagnose, prescribe, treat, or offer medication.

FIRE PREVENTION AND CONTROL

Each science teacher must be prepared to act deliberately and intelligently in the event of a classroom fire. The teacher's first concern should be to evacuate the area. It is equally important to know the location of the available fire fighting aids (blanket, extinguishers and fire alarm box) and how to use them.

The principal concern in any materials fire is to move students from the fire area immediately. The teacher must quickly determine the immediate and potential danger from the fire. If there is any chance that the fire might spread or represent a danger to the classroom or students, the fire alarm must be sounded. It is the teacher's responsibility to know the location of the fire alarm box nearest the classroom.

A common type of accidental fire in the science laboratory is caused by a student's leaning too close to an open flame and igniting his/her clothing or hair. In either case, water is an effective remedy. A fire blanket is the most effective remedy to use to smother the fire. Do not use a CO_2 fire extinguisher on an individual. A CO_2 blast could spread the fire and could possibly cause frost-bite, thereby compounding the injury.

Among other common causes of laboratory fires include failure to understand the nature of the supplies or equipment being used; carelessness in the handling of them; horseplay; and the accumulation of combustible debris (such as paper towels).

Teachers should be familiar with routine fire fighting equipment and procedures. The fire blanket should be wool rather than asbestos. In case of explosion, burners and other heaters must be immediately turn off. Teachers should stop addition of reagents, assist in treating victims, and vacate the room. Since toxic gases may be present, everyone should evacuate the room until it is decontaminated. Injured persons should be examined and given appropriate first aid for burns, cuts and chemicals on the skin and in the eyes and then should be referred to proper medical treatment.

Firefighting

1. As a general rule, the physical area immediately surrounding a fire should be cooled with an extinguisher to prevent the flames from spreading, then the base of the blaze extinguished, and finally, the scattered remnants of the fire smothered.

2. The first step in fighting an electrical fire is to pull the plug. A carbon dioxide fire extinguisher should be used since it is a non-conductor of electricity. Exercise caution to avoid electrocution or shock by handling only insulated material.

3. Sand, fire blanket, vermiculite, bicarbonate of soda, etc., should be kept on hand for fires and absorption of spilled reactants.

Classes of Fires and Extinguishers

There are four general classes of fires. Using the proper type of extinguisher for each class will give the best control.

Class A Fires in wood, textiles, paper and other ordinary combustibles.

This type of fire is extinguished by cooling with water or a solution containing water (loaded steam) which wets down the material and prevents glowing embers from rekindling. A general purpose foam or dry chemical extinguisher is also effective.

Class B Fires in gasoline, oil, paint, grease or other flammable liquids that gasify when heated.

This type of fire is extinguished by smothering the air supply. Carbon dioxide, dry chemical, and foam are effective on this type of fire.

To use a dry chemical or carbon dioxide extinguisher, pull the pin, point the nozzle at the flame, and squeeze the handle. Do not hold the horn of the carbon dioxide extinguisher with your hands; use the handle since the carbon dioxide causes supercooling of the horn.

To use a foam extinguisher, invert the extinguisher and point the nozzle in such a way as to cause the foam to float over the fire; do not point the stream at the flame. This extinguisher does not have a cut-off valve and must be completely expelled.

Class C Fires in live electrical equipment and areas where electricity is present.

This type of fire is extinguished by using a non-conductive agent. A carbon dioxide extinguisher smothers the flame without damaging the equipment. A dry chemical extinguisher is also effective. Whenever possible, the source of power to the burning equipment should be cut off. Avoid becoming part of the circuit.

Class D Fires in combustible materials such as magnesium, titanium, zirconium, sodium, potassium, zinc, lithium or metal hybrides.

This newly classified and somewhat specialized type of fire is extinguished by a special extinguisher powder, unlike dry chemical and general purpose dry chemical, which is applied by a scoop. Dry sand, dry soda ash or sodium chloride may also be used to extinguish small Class D fires. Apply by scoop.

Fire extinguishers approved by Underwriter's Laboratories are labeled with the class of fire for which it is most effective.

NOTE: The material on this page can be posted where students and teachers have quick and frequent areas to it. Teachers can use pictures and other illustrations to reinforce and clarify the information for their students.

EYE AND FACE PROTECTION

Many activities in a science lesson may present danger from flying particles or objects, splattering hot or corrosive substances, or damaging radiation. Since the eyes are especially vulnerable to injury from such hazards, teachers must take measures to provide adequate eye protection during these activities.

The type of eye protection device needed depends on the particular job to be done. For most laboratory work, splash proof goggles are sufficient. It is good to assume that accidental exposure to chemicals or particulates will occur, therefore require students to wear chemical resistant goggles in any operation when such dangers are present. (Models are available to be worn over eyeglasses.)

The Food and Drug Administration (FDA) requires all eyeglass and sunglass lenses sold to the general public be of shatter-resistant material. Be aware that, although this regulation improves the protection to the general public, such eyeglasses cannot be considered adequate for science laboratories which require industrial quality eye protection devices. The principal difference is that the FDA requires hardened lenses with a minimum thickness of 2mm, while the American National Standards Institute (ANSI) standards require a minimum thickness of 3mm, lens retaining frames, non-flammable frames, and other attributes not covered by the FDA regulation.

A full face shield should be worn when working with glassware under reduced or elevated pressure and with glass apparatus used in combustion or other high temperature operation. It should also be worn when diluting concentrated acids, bases or other corrosive substances. Goggles should be worn beneath the face shield.

It is strongly recommended that the wearing of contact lenses in the laboratory be discouraged; if used, protection by goggles should be required. Wearing of contact lenses in the laboratory with safety glasses should <u>not</u> be permitted since there is a distinct possibility that chemicals may infuse under the contact lenses and may cause irreparable eye damage.

Prior to any work in the chemical laboratory, plans and facilities must be established for action to be taken in the event of splashing of chemicals in or near the eye. Adequate attention to the immediate flushing of the eye with clean, tempered water from a gentle flowing source, such as an eyewash fountain, for a predetermined time (10 to 15 minutes is the usual recommendation) should be followed by prompt treatment by the student's family physician or an opthalmologist especially acquainted with chemical injuries.

NEW JERSEY LAWS, RULES, AND REGULATIONS CONCERNING THE USE OF EYE PROTECTIVE DEVICES

NOTE: School personnel should become familiar with these rules and regulations since teachers and school officials are legally responsible for enforcing them.

N.J.S.A. 18A:40-12.1. Protective eye devices required for teachers, pupils and visitors in certain cases. The board of education of every school district shall require each pupil and teacher in the public schools of the district to wear industrial quality eye protective devices while attending classes in vocational or industrial art shops or laboratories in which caustic or explosive chemicals, hot liquids or solids, hot molten metals, or explosives are used or in which welding of any type, repair or servicing of vehicles, heat treatment or tempering of metals, or the milling, sawing, stamping or cutting of solid materials, or any similar dangerous process is taught, exposure to which might have a tendency to cause damage to the eyes. Visitors to such classrooms or laboratories shall also be required to wear such protective devices.

N.J.S.A. 18A:40-12.2. Rules prescribing kinds, types and quality of devices. The Commissioner, by rule or regulation, shall prescribe the kinds, types and quality of such protective devices, and in so doing, the Commissioner shall be guided by the standards promulgated by the American Standards Association, Inc. for such protective devices. [NOTE: A.S.A.I. is now known as the American National Standards Institute, Inc. (ANSI).]

N.J.A.C 6:3-1.14. Eye protective in public schools.

(a) Each district board of education shall require each pupil, teacher and visitor in the public schools of the district, including evening adult schools programs, to wear appropriate eye protective devices while participating in vocational education, industrial arts education, science education and arts education in which caustic or explosive chemicals or materials, hot liquids or solids, molten materials, welding operations of any type, repairing or servicing of vehicles, heat treatment or tempering of metals, the shaping of solid materials and laser device operation and experimentation or any similar process or activity is engaged in, exposure to which might have a tendency to cause damage to the eyes.

(b) The term "appropriate eye protective device" shall include plano or prescription lenses provided the lenses and other portions of the device meet or exceed the prescribed specifications for the device. Specifications for appropriate eye protection for various activities shall meet or exceed standards described in 1 and 2 below. The standards, with all subsequent amendments and supplements. are hereby adopted as rules.

1. American National Standards Practice for Occupational and Educational Eye and Face Protection, ANSI Z87.1-1979.

2. American National Standard Practice for the Safe Use of Lasers, ANSI Z136.1-1980 and eye protective procedures recommended by the manufacturer of the laser device.

i. These documents are available for review at the Administrative Code Office, Department of Education, 225 West State Street, CN 500, Trenton, New Jersey 08625.

ii. These documents may be purchased from American National Standards institute, Incorporated 1430 Broadway, New York, New York 10018.

(c) Emergency eye wash fountains or similar devices, capable of a minimum 15 minutes continuous flow of eye wash solution shall be provided in classrooms, shops, laboratories or other area where pupils or instructors are exposed to caustic materials that can cause damage to the eyes.

(d) The following types of eye protective devices shall be used to fit the designated activities or process:

Potential Eye Hazard	Eye Protective Device(s)
1. Caustic or explosive materials	Goggle, flexible fitting, hooded ventilation; and plastic window face shield or severe explosure;
2. Dust producing operations	Goggle, flexible fitting, hooded ventilation;
3. Electric are welding	Welding helmet in combination with spectacles with eye cup or semi or flat-fold side shields;
4. Oxy-acteylene welding	Welding goggle, eye cup type with tinted lenses; welding goggle, coverspec type with tinted lenses or tinted plate lense;
5. Hot liquids and gases	Goggle, flexible fitting, hooded ventilation; add plastic window face shield for severe exposure;
6. Hot solids	Clear or tinted goggles or spectacles with side shields;
7. Molten materials	Clear or tinted goggles and plastic or mesh window face shield;
8. Heat treatment or tempering	Clear or tinted goggles or clear or tinted spectacles with side shields;
9. Glare operations	Tinted goggles; tinted spectacles with side shields or welding goggles, eye cup or coverspec type with tinted lenses or plate lense;

10.	Shaping solid materials	Clear goggles, flexible or rigid body; clear spectacles with side shields; add plastic window face shield for severe exposure.
11.	Laser device operation or experimentation	Appropriate for specific hazard;
12.	Repair or servicing of vehicles	Clear goggles, flexible or rigid body; clear spectacles with side shields;
13.	Other potentially eye hazardous processes or activities.	Appropriate for specific hazard.

(e)Each district board of education shall establish and implement specific eye protective policy and program to assure that:

1. No teacher, pupil or visitor shall be subjected to any hazardous environmental condition without appropriate eye protection.
2. The detection of eye hazardous conditions shall be continuous.
3. Eye protective devices shall be inspected regularly and adequately maintained.
4. Shared eye protective devices shall be disinfected between uses by a method prescribed by the local school medical inspector.
5. All eye protective devices shall meet or exceed the appropriate specifications for the various types of devices and suppliers of eye protective devices shall certify, in writing, that the device meets or exceeds said specifications.
6. Specific policy and procedure shall be established to deal with individuals who refuse to abide by established eye safety practices and procedures.
7. Contact lenses use shall be restricted in learning environments which entail exposure to chemical fumes, vapors or splashes, intense heat, molten metals, or highly particulate atmospheres. Contact lenses, when permitted, shall only be worn in conjunction with appropriate eye protective devices and the lense wearer shall be identified for appropriate emergency care in eye hazardous learning environments.
8. All spectacle type eye protective devices shall have side shields of the eye cup, semi or flat-fold type.
9. Pupils, teachers or visitors wearing personal corrective eyewear shall be required to wear cover goggles or similar devices unless it can be certified, competent authority, that the personal eyewear meets or exceeds standards identified in subsection(b) above.

N.J.A.C. 6:53-9.4. Emergency eyewash facilities.

A. Emergency eyewash equipment shall be installed in areas in which acid-base battery electrolytes are used.

B. Emergency eyewash stations may be of the portable or permanently installed type. Eyewash stations shall be inspected and maintained in accordance with the recommendations of the manufacturer.

Eye Safety Devices

Allocations of eye safety devices are recommended as follows:

	Device	Recommended Allowance
1.	Goggles, plastic splash proof	1 class set for each school laboratory
2.	Face shield, quick adjustable	1 for each teaching station, prep room and project room
3.	Storage case, for goggles	Same as No. 1
4.	Shield, safety	1 per science laboratory area or room

The devices described above provide eye protection for personnel in the following manner:

Goggles - Protection against impact and splash — reduction of dust and fumes.

Face Shield - Partial protection of face against impact and splash.

Safety Shield - Group personal protection from splash and impact.

These devices should not be considered 100 percent effective against all potential eye hazards. Appropriate combinations of devices may be used for optimum protection.

Establishing an Eye Protection Program

In order to establish an effective eye safety program, teachers should:

1. Orient students to the need for and the use of eye protection devices.

2. Consider eye safety when planning each science activity.

3. Establish routine procedures for the distribution of the individual eye protection devices when needed and for their subsequent return to the storage case.

4. Maintain strict standards for cleanliness, since eye protection devices will usually be shared by several persons, although it is best for each student to have her/his own pair. Students with unhealthy, possibly contagious skin or eye conditions should be encouraged to purchase personal safety glasses, or a pair should be reserved for their exclusive use.

5. Establish a definite, readily accessible location in the designated areas for each type of eye protection device.

6. Shield both pupils and teachers from demonstrations involving hazards to the eyes. The safety shield should be used to protect all in the general area, and the face shield and/or goggles to protect the teacher and students. Size of apparatus and quantities of reagents used in a demonstration should be limited based on the potential hazard that may occur if there should be an accident.

7. Ensure that all persons performing science laboratory activities involving hazards to the eye wear the approved eye protection devices. All persons in dangerous proximity to such activities must be likewise equipped. For example, in laboratory experiments involving hazardous substances or procedures, all persons must be appropriately protected with goggles and/or face shields. Visitors to the laboratory must also be adequately equipped with goggles.

8. Because of the greater probability and severity of many eye hazards in storerooms, preparation rooms and project rooms, all persons performing or observing hazardous activities in these areas should be equipped with splash proof chemical goggles and face shield.

Specific Hazardous Activities

Eye protection devices as prescribed by ANSI standards should be provided for participants and observers in the following situations:

Impact Hazards

- Observing pneumatic pressure or evacuation devices, including pressure cooker
- Operating of power tools
- Operating of centrifugal (centripetal) devices
- Demonstrating projectile and collision devices
- Handling of elastic materials under stress; e.g., springs, wires, rubber, glass, etc.
- Working with or igniting explosive or implosive devices or substances
- Working with hot, molten metals
- Hammering, chipping or grinding rocks, minerals, and metals
- Cutting or breaking glass

Hazardous Substances

- Pouring, pumping or dispensing corrosive substances
- Heating or electrolysis of chemicals
- Mixing chemicals
- Preserving, dissecting and straining biological specimens or cultures
- Cleaning and sterilizing with corrosive substances, including ammonia, detergents and solvents

Hazardous Radiation

- Direct viewing of the sun. (There is no safe eye protection against this hazard. Avoid this activity.)
- Use of infrared and ultra-violet sources. (An approved welder face shield is effective, but it is recommended that these sources be shielded from direct view.)
- Use of lasers. (Lasers represent a special hazard to both eyes and skin. Knowledge of the equipment should be obtained before any use is contemplated.)

Maintenance and Disinfection of Eye Protectors

Maintenance

1. The lenses of eye protectors must be kept clean. Continuous vision through dirty lenses can cause eye fatigue and become a contributory factor to accidents. Daily cleaning of eye protectors is recommended.
2. Pitted or scratched lenses should be replaced immediately as they reduce vision and seriously reduce protection.
3. Replace worn headbands as slack, worn-out, sweat-soaked, knotted or twisted headbands do not hold the eye protector in proper position. A visual inspection can be used to determine when the elasticity is reduced to a point beyond proper function.
4. Store eye protectors in suitable cases or containers between periods of use.

Disinfection

1. Eye protectors are a personal item and should be for the individual and exclusive use of the person to whom they are issued. If circumstances require reissue, the protectors shall be thoroughly cleaned and disinfected as described below.

2. To keep eye protection devices clean:

   a. Thoroughly clean all surfaces with soap or suitable detergent and warm water.

   b. Carefully rinse all traces of soap or detergent.

   c. Completely immerse the protector for 10 minutes in a solution of modified phenal, or hypochlorite, or quaternary ammonium compounds, in a strength specified by the manufacturer, at a room temperature of 68° F. Remove protector from solution and suspend in a clean place for air drying at room temperature, or with heated air. Do not rinse because this will remove the residual effect.

OR

Ultraviolet disinfecting equipment may be utilized when such equipment can be demonstrated to provide comparable disinfection.

OR

Provide each student with a personal set. Protectors showing need for extensive cleansing should be capable of being disassembled without tools prior to the washing and disinfection procedure. Replace defective parts with new ones.

GENERAL PERSONAL SAFETY

The science classroom is potentially the most dangerous place in the school. However, this need not constitute a serious threat if the teacher and students have a thorough knowledge of the potential hazards, exercise prudent care and foresight, and use common sense. Accident prevention must be included in the performance of every task, and safety instruction must be an integral part of the overall science program.

1. Precautions should be taken to protect those in the classroom from injury from hot or corrosive materials.

   a. In order to reduce the danger from caustic or hot liquids, students and teachers handling such materials should wear protective aprons (plastic or neoprene), goggles, and should roll sleeves (which can absorb the liquid) tightly to above the elbow.

   b. Students should never be permitted to work with concentrated acids or bases or with boiling water while seated.

   c. Burns from either hot or caustic materials should be flooded immediately and for at least ten minutes with copious amounts of cold water. Following flooding of the burn, the victim should be escorted to the school nurse as quickly as possible. Clothing which has absorbed caustic material should be removed as soon as feasible. The school nurse should be called immediately.

2. High-speed devices such as mechanical rotators, electric drills, fans, etc, should never be operated with protective shields removed or opened. Goggles must be worn.

3. Eating anything in the laboratory should be prohibited since it entails an intolerable hazard from toxic or possible infectious materials.

4. Cleanliness and order should be maintained.

   a. Extraneous objects should be removed from work surfaces. Accidents tend to be intensified by clutter.

   b. Glassware and other hardware should be maintained in a clean condition. Chemical or biological residues may constitute a reactive hazard.

   c. Students should be required to thoroughly wash their hands with soap and water following a laboratory session.

5. There are several devices for protecting students and instructors against the corrosive or toxic effects of chemical reagents.

   a. Aprons should be worn by all students working in a laboratory, especially when working with corrosive reagents.

b. Gloves should be worn by students when working with concentrated corrosive reagents. Gloves have a tendency to reduce dexterity, which may be a hazard in itself. Gloves are generally rubber or plastic.

c. Long hair can be a serious hazard in the laboratory and should be covered or contained. Fire and reduced visibility are just two of the hazards that result from long hair.

d. Loose clothing is another potential safety hazard in the laboratory. Loose clothing is less controllable then tight-fitting clothing. Glassware can be knocked off benches, clothes can come into contact with open flame, and manual dexterity can be reduced.

6. In a demonstration experiment using any flammable liquid such as alcohol, care must be taken to ensure that any flame in the room is a safe distance from the volatile liquid.

7. Demonstrations involving explosive or potentially explosive substances must be so arranged as to shield everyone from any danger. Use the safety shield to protect observers and the face shield and goggles to protect the demonstrators. Size of apparatus and quantities of reagents used in demonstration should be consistent with safe practice.

8. Observers should be evacuated from seats directly in front of the demonstration table, even if the possibility is remote that injury to them might occur from spattering of chemicals, inhalation of fumes, etc.

9. All persons performing science activities involving hazards to the eyes must wear approved eye protection devices. All persons in dangerous proximity must likewise be equipped.

10. Chemicals should never be tasted (or placed on the tongue or lips), nor should laboratory glassware be used as drinking vessals.

11. Sandals and open-toe shoes should not be permitted in laboratory areas unless they have a protective covering.

CHEMICAL SAFETY

The following points are made to assist teachers who are working with chemicals in maintaining a safe learning environment.

1. Teachers should consult available information before using chemicals to determine if chemicals are poisonous, corrosive, caustic or flammable. In case of an accident, they should know what to do for possible external or internal exposure, notify the nurse or doctor immediately, and be able to give the appropriate information about the chemical s) involved.

2. Safety splash proof goggles must be worn when any corrosive, caustic, hot or flammable chemicals are being used in the immediate area. Examples of such chemicals are paint removers, insides of dry cells and hot waxes.

3. Containers of chemicals should be labeled with the name of the chemical, the concentration, the date when purchased or prepared, and any hazardous property of the chemical.

4. To avoid contamination of chemicals, chemicals should never be returned to the original containers once they have been removed. Chemicals once removed from the original container should be either used or disposed of properly.

5. Random mixing of chemicals must be prohibited.

6. Flammable chemicals should never be used or left near heat sources.

7. Gifts of chemicals from students, parents or surplus agencies are to be discouraged since the age, strength and condition of these chemicals may not be known.

8. Dry ice (solid carbon dioxide) must never be handled with bare hands. Dry ice can cause severe frostbite which heals slowly and is very painful. The use of insulated gloves is suggested.

9. Hands must be washed after using any chemicals. Hands should be kept away from face and mouth during all laboratory work.

10. Eating or drinking must not be allowed in the laboratory.

11. Tasting chemicals must be prohibited unless specifically directed by teacher.

12. When using acids, a neutralizing solution such as baking soda and water should be available in case of spills; conversely, when using strong bases, a neutralizing solution such as vinegar should be available.

13. Dispose of used or excess chemicals properly and promptly.

14. Students should not carry chemicals or laboratory equipment through the halls. Rolling carts should be used to transport them if necessary.

15. When chemicals are spilled on skin or splashed in eyes, use water to wash the eyes for a minimum of 10 minutes. The nurse should be consulted as soon as possible.

16. Pipetting (withdrawing of liquids) chemicals should always be done with rubber bulbs or similar equipment, never by mouth.

17. The following compounds are extremely hazardous and should never be used in an elementary school. If present, they should be disposed of properly and as soon as possible. Contact a district chemistry teacher about proper means of removal and coordinate the process with your building principal.

    Ammonium dichromate
    Ether, Benzine, Chloroform, Carbon tetrachloride
    Mercury or any of its compounds
    Alkalai metals, such as potassium, sodium or lithium
    Halogens, such as chlorine, fluorine, bromine or iodine
    Phosphorous (in any form)
    Formaldehyde (or formalin solution)
    Peroxides of any type (except 3% solutions of hydrogen peroxide)
    Perchlorates of any type

TABLE 1: DANGEROUS COMBINATIONS OF SOME COMMON SCHOOL CHEMICALS

Some chemicals are dangerous in themselves or become dangerous when combined with other substances. The following table lists these combinations. Chemicals that are starred (*) should not be used in elementary grades.

Compound	Should Not Come In Contact With:
Acetic Acid (Vinegar)	Nitric acid, peroxides,* permanganates, ethylene glycol, hydroxyl compounds.*
Ammonium nitrate	Acids, flammable liquids, metal powders, sulfur, chlorates, any finely divided organic or combustible substance.
Chlorates (Swimming Pool Chemicals)	Ammonium, salts, acids, metal powders, sulfur, any finely divided organic or combustible substances.
Hydrogen peroxide (liquid bleach)	Most metals and their salts, alcohols, organic substances, any flammable substance.
Hydrocarbons; e.g., propane, gasoline, etc. (Outdoor grill fuel)	Fluorine,* chlorine,* bromine,* sodium peroxide.*

Compound	Should Not Come In Contact With:
Iodine	Acetylene, ammonia, hydrogen.*
Nitric acid	Acetic acid, hydrogen sulfide, flammable liquids and gases.
Potassium chlorate	Sulfuric and other acids, any organic substance.
Potassium permanganate	Sulfuric acid, glycerine, ethylene glycol.
Sulfuric acid*	Potassium chlorate, potassium perchlorate,* potassium permanganate, similar compounds of other light metals.

HEATING ACTIVITIES

To promote a safe learning experience the following precautions should be heeded when performing activities related to heating in the science classroom.

1. Whenever using an open flame in a classroom, students with long hair should wear hair bands, and loose-fitting clothes should be checked and secured.

2. The work area for heating activities should be free of combustible materials.

3. Candles may be used in elementary classrooms by students under the supervision of the teacher. Candles should be placed in a drip pan before use.

4. Safety matches may be used in elementary science classrooms by students supervised by their teachers. Students should be instructed in match safety prior to lighting a match. A clean, small jar with a screw-on lid partially filled with water serves well as a safe container for used matches. After the match is deposited in the jar, the lid should be replaced to extinguish any remaining sparks. (Lids are an excellent safety device for extinguishing fires.)

   The following steps for match safety are strongly suggested. (Teachers may wish to list the following steps on a poster for classroom display.)

   a. Open match jar.

   b. Open match box or cover and remove one match.

   c. Close match box or cover.

   d. Strike match away from you.

   e. Blow out match.

   f. Place in match jar.

   g. Replace top on match jar.

5. For heating activities involving alcohol burners, the following precautions should be applied:

   a. Only broad-based alcohol burners should be used.

   b. Burners are to be checked prior to beginning a lab. Burners are to be <u>refilled only by the teacher</u>. Goggles are to be worn.

c. If a burner must be refilled during the class, the teacher must be notified. When refilling, precaution should be taken with the heated burner (hot metal can ignite alcohol) .

d. Squeeze-type plastic bottles should be used to refill alcohol lamps.

e. A well ventilated, uncluttered area should be designated as the "refilling station." This area should be labeled and serve as the only area used to refill burners. It should be located on a separate table and away from any flame.

6. Propane burners are not recommended as heat sources for use by elementary students.

7. Hot plates with smooth surfaces are suggested instead of hot plates with coils.

8. Any hot material should not be moved until it has cooled.

9. Heat sources should not be left unattended until they are cool.

10. Do not use thermometers to stir liquids as the glass tube may break. Do not place thermometers in liquids or on hot surfaces that exceed the highest temperature indicated on the thermometer, as the glass tube may explode.

NOTE: This material should be posted where students and teachers can have quick and easy access to it.

SAFETY WITH PLANTS

Poison ivy, poison oak, and poison sumac are well advertised outdoor dangers, but growing around them in woods, fields, backyards, and even in the home are some 700 other species of plants known to cause death or illness. Teachers should familiarize themselves with the most common poisonous plants typically found in their area.

Since ALL plants have not been thoroughly researched for their toxicity, a few common rules are:

A. Never eat unknown berries, seeds, fruits or other plant parts.

B. Never rub any sap or fruit juice into or on the skin or open wound.

C. Never inhale or expose your skin or eyes to the smoke of any burning plant or plant parts.

D. Never pick any strange wildflowers or cultivated plants unknown to you.

E. Never eat food after handling plants without first scrubbing your hands.

The reason for these "Never" precautions is that any part of a plant can be relatively toxic.

Since many families may use dangerous insecticides for their gardening, students should be instructed about the danger of handling these toxic substances. Also, students should be instructed that when working with plants that have been sprayed by insecticides, they must take the same precautions that they would when working with any hazardous chemical substance.

Teachers should become suspicious and act very quickly if they notice any of their students exhibiting any of the following signs of plant poisoning -- constriction of pupils, increase in nasal and salivary secretions, sweating, gastrointestinal disturbance, tightness in the chest, muscle tremor, blueness around the lips and under the fingernails, or indications of convulsions. First aid measures may have to be taken and the Poison Control Center alerted.

Pollen and Mold Spores

In handling flowers and other pollen-producing plants and mushrooms as well as spore-producing fungi, care should be taken that pollen or spores are not excessively disseminated throughout the classroom. Many people are allergic to either pollen, mold spores or to both.

Some Poisonous House Plants

Certain plants in or around the home can be poisonous when ingested. The National Clearinghouse for Poison Control Centers reports over 14,000 people (mostly under age 5) swallow or are exposed to parts of poisonous plants annually.

In all, 91 plants are capable of causing problems which range from vomiting and diarrhea to convulsions, paralysis and respiratory failure.

Dr. Guy Hartman of the Kaiser/Permanent Medical Center in Fontana, California, creator of the "sinister garden" of poisonous plants that received nationwide attention in 1976, believes that in excess of 400,000 poisonings from plants occur each year in the United States.

Some plants grown in American homes are considered toxic. For example, the leaves on philodendrons are poisonous, but the species known as "monstera" is particularly harmful if ingested (see list of poisonous plants). Hyacinth, often purchased as a flowering plant for indoor display, contains an alkaloid poison in the bulb. Dephiniums are injurious if the seeds or leaves are ingested. The bark and foliage of the bird-of-paradise plant are similarly toxic.

Outdoor garden plants constitute the majority of those on the poisonous plant list. Most dangerous is the seed contained in castor beans and, to a lesser extent, all parts of the oleander plant found in southern parts of the nation. Horticulturalists and doctors advocate the removal of these plants from the garden, especially where there are children.

A common sense approach to plant poisons will eliminate most dangers. If youngsters or toddlers are in the home, remove all house plants that are known to be poisonous; placing them well out of reach of children is an easy way of removing the hazard. In the outdoor garden, instruct young children not to touch the plants nor to put leaves or berries in their mouths. Consider removing poisonous plants from the garden or transplanting those plants to a garden that is not accessible to children.

In an emergency, identification of the poisonous plants involved will assist a hospital in providing proper medical attention. If you don't know the plant, bring a specimen to the hospital for quick identification. Write down the telephone number of the nearest Poison Control Center before an emergency occurs.

Other Poisonous Plants

What are the most prominent poisonous plants? According to Dr. John M. Kingsbury, author of "Poisonous Plants of the United States and Canada," here are some of the plants to watch out for:

Azaleas: All parts of the plants are poisonous. Ingestion of any parts will likely cause nausea, vomiting, weak spells, difficult breathing, loss of balance and dizzy spells.

Castor Beans: The seeds (beans) are poisonous. On ingestion, there will be severe vomiting, diarrhea, convulsions, kidney damage and possibly death.

Delphinium (Larkspur): All parts of the plant are considered poisonous, especially the seeds. If swallowed, plant parts will cause burning sensations of the mouth, vomiting, low blood pressure, weak pulse and convulsions.

Foxglove: Only the leaves are poisonous. Symptoms include pains of the abdomen, irregular heartbeat, vomiting, tremors and convulsions.

Holly (Ilex): The berries occurring on female plants are the only parts to be avoided. Swallowing of the berries leads to diarrhea, vomiting and depression of the central nervous system.

Iris: Most plant parts are said to be toxic, including the bulb, leaves and flower stalk. Symptoms are blistering of the mouth and lips as well as diarrhea and vomiting.

Jerusalem Cherry: Both the leaves and the berries are toxic. Ingestion would cause diarrhea, vomiting, depression of the nervous system, respiratory problems and convulsions.

Monstera (Philodendron Species): Only the leaves are harmful. Symptoms include diarrhea, vomiting and a burning sensation of the mouth.

Oleander: All parts are poisonous. Among the diverse symptoms are abdominal pains, dilation of the pupils, bloody diarrhea, vomiting, slow and irregular heartbeats and paralysis of the respiratory system.

Poison Ivy: Symptoms are usually confined to blisters and itching.

Poison Oak: Blisters and itching are common symptoms.

Privet (Ligustrum): Leaves and berries are poisonous. Ill effects include diarrhea, low blood pressure, vomiting and kidney damage.

Yew (Taxus): All parts of the plant are poisonous, especially the berries. If swallowed, dilated pupils, diarrhea, vomiting, weak spells and convulsions are likely to occur.

For a more complete listing of plants, see Table 2 on the next several pages.

TABLE 2: COMMON POISONOUS PLANTS

This alphabetical list is intended only as a guide and an extension of the previous list.

If you are uncertain about the poisonous properties of a particular plant, contact your veterinarian or agricultural extension service office or consult Walter Muenscher's Poisonous Plants for the United States (Collin Books, 1975). In evaluating the toxic properties of plants which you are considering for home or garden, do not rely upon the opinions of store clerks or hobby gardeners. Several so-termed "harmless" plants may form toxic products when decomposed, or they may produce a poisonous substance as a result of interaction with a microorganism such as fungi. Several plants cause poisoning only during certain seasons of the year, and other plants produce toxic agents only during particular stages of development.

PLANT	TOXIC PARTS	PLANT TYPE
Aconite	Root, foliage, seeds	Garden flower
Apple	Seeds	Cultivated tree
Arrowgrasses	Leaves	March plants
Atropa Belladonna	Entire plant, especially seeds, roots	Garden herb
Autumn Crocus	Entire plant	Garden flower
Azaleas	Entire plant	Cultivated and wild shrub
Baneberry	Berries, roots	Wildflower
Bird-of-Paradise	Pods	Garden flower
Black Locust	Entire plant, especially bark, shoots	Tree
Bloodroot	Entire plant, especially stem, roots	Wildflower, herb
Box	Entire plant, especially leaves	Ornamental shrub
Buckeye	Sprouts, nuts, seeds	Tree
Buttercup	Entire plant, especially leaves	Wildflower, garden herb
Caladium	Entire plant	House plant
Carolina Jessamine	Flowers, leaves	Ornamental plant

PLANT	TOXIC PARTS	PLANT TYPE
Castor Bean	Entire plant, especially beans	House plant
Chinaberry	Berries	Tree
Oleander	Leaves	Ornamental Shrub
Philodendrons	Entire plant	House plant
Pokeweed	Roots, seeds, berries	Field plant
Poinsettia	Leaves, stem, flowers	House plant
Poison Hemlock	Leaves, stem fruit	Field plant
Potato	Shoots, sprouts	Garden plant
Common Privet	Leaves, berries	Ornamental shrub
Rattle Box	Entire plant	Wildflower
Rhododendron	Leaves	Ornamental shrub
Rhubarb	Leaves	Garden plant
Rosary Pea	Seeds	House plant
Skunk Cabbage	Entire plant, especially roots, leaves	Marsh plant
Smartweeds	Sap	Wildflower
Snow-on-the-Moutain	Sap	Field plant
Sorghum	Leaves	Grass
Star of Bethlehem	Entire plant	Wildflower
Velvet Grass	Leaves	Grass
Wild Black Cherry	Leaves, pits	Tree
Wild Radish	Seeds	Wildflower
Wisteria	Pods, seeds	Ornamental plant
Woody Aster	Entire plant	Wildflower
Yellow Jessamine	Entire plant	Ornamental plant

PLANT	TOXIC PARTS	PLANT TYPE
Yellow Oleander	Entire plant, especially leaves	Wildflower
Yellow Pine Flax	Entire plant, especially seed-pods	Wildflower
Yew	Bark, leaves, seeds	Ornamental tree

For a listing of symptons of poisonous plants, see following pages.

TABLE 3: SYMPTOMS OF PLANT POISONING

House Plants

Hyacinth, Narcissus, Daffodil (Bulbs)
Nausea, vomiting, diarrhea. May be fatal.

Oleander (Leaves, Branches)
Extremely poisonous. Affects the heart, produces severe digestive upset, and has caused death.

Dieffenbachia, Elephant's Ear (All Parts)
Intense burning and irritation of the mouth and tongue. Death can occur if base of the tongue swells enough to block the air passage of the throat.

Rosary Pea, Castor Bean (Seeds)
Fatal. A single rosary pea seed has caused death. One or two castor bean seeds are near the lethal dose for adults.

Poinsettia (Leaf)
One leaf can kill a child.

Mistletoe (Berries)
Can be fatal.

Flower Garden Plants

Larkspur (Young Plant, Seeds)
Digestive upset and nervous excitement.

Monkshood (Fleshy Roots)
Digestive upset and nervous excitement.

Autumn Crocus, Star-of-Bethlehem (Bulbs)
Vomiting and nervous excitement.

Lily of the Valley (Leaves, Flowers)
Irregular pulse, usually accompanied by digestive upset and mental confusion.

Iris (Underground Stems)
Severe, but not usually serious, digestive upset.

Foxglove (Leaves)
One of the sources of the drug digitalis, used to stimulate the heart. In large amounts, the active principles cause dangerously irregular pulse, usually digestive upset and mental confusion. May be fatal.

Bleeding Heart, Dutchman's Breeches (Foliage, Roots)
May be poisonous in large amounts.

Rhubarb (Leaf Blade)
Fatal. Large amounts of raw or cooked leaves can cause convulsions, coma, followed rapidly by death.

Ornamental Plants

Daphne (Berries)
Fatal. A few berries can kill a child.

Wisteria (Seeds, Pods)
Mild to severe digestive upset. Many children are poisoned by this plant.

Golden Chain (Bean-like capsules in which seeds are suspended)
Severe poisoning. Excitement, convulsions, and coma. May be fatal.

Laurel, Rhododendron, Azalea (All Parts)
Fatal. Produces nausea and vomiting, depression, difficult breathing, prostration, and coma.

Jessamine (Berries)
Fatal. Digestive disturbance and nervous symptoms.

Lantana Camera — Red Sage (Green Berries)
Fatal. Affects lungs, kidneys, hearing and nervous systems. Grows in the southern United States and in moderate climates.

Yew (Berries, Foliage)
Fatal. Foliage more toxic than berries. Death is usually sudden without warning symptoms.

Trees and Shrubs

Wild and Cultivated Cherries (Twigs, Foliage)
Fatal. Contains a compound that releases cyanide when eaten. Gasping, excitement, and prostration are common symptoms that often appear within minutes.

Oaks (Foliage, Acorns)
Affects kidneys gradually. Symptoms appear only after several days or weeks. Takes a large amount for poisoning. Children should not be allowed to chew on acorns.

Elderberry (Shoots, Leaves, Bark)
Children have been poisoned by using pieces of the pithy stems for blowguns. Nausea and digestive upset.

Black Locust (Bark, Sprouts, Foliage)
Children have suffered nausea, weakness, and depression after chewing the bark and seeds.

Wooded Area Plants

Jack-in-the-Pulpit (All Parts, especially Roots)
Like dieffenbachia, contains small needle-like crystals of calcium oxalate that cause intense irritation and burning of the mouth and tongue.

Moonseed (Berries)
Blue, purple color, resembling wild grapes. Contains a single seed. (True wild grapes contain several small seeds.) May be fatal.

May Apple (Apple, Foliage, Roots)
Contains at least sixteen active toxic principles, primarily in the roots. Children often eat the apple with no ill effects, but several apples may cause diarrhea.

Swamp or Moist Area Plants

Water Hemlock (All Parts)
Irritant juices may severely injure the digestive system.

Nightshade (All Parts, especially the Unripe Berry)
Fatal. Intense digestive disturbances and nervous symptoms.

Poison Hemlock (All Parts)
Fatal. Resembles a large wild carrot.

Jimson Weed — Thorn Apple (All Parts)
Abnormal thirst, distorted sight, delirium, incoherence, and coma. Common cause of poisoning. Has proved fatal.

BIOLOGY AND LIFE SCIENCE SAFETY

Safety and Health

The following precautions must be observed in any classroom in which microorganisms or animals are studied or used:

1. No food or drink should be stored, taken into or consumed in the classroom.

2. Students and teachers should wash their hands thoroughly before leaving the classroom if they handled the animals.

3. Extraneous items such as books, coats and umbrellas should be left outside the classroom.

Live Animals in The Classroom

The first aim of demonstrations that involve animals in classrooms is to have students gain an understanding of life processes. Such studies lead to a sympathetic respect for life. A second aim of animal studies is to provide future citizens with some knowledge of the principles of health, disease and medicine and some aspects of agriculture. By achieving these goals, some students are motivated to become the medical and biological scientists of the future.

Much can be learned about life processes from microorganisms and plants; invertebrates and cold-blooded vertebrates can be used for many animal studies, but birds and mammals are essential to the demonstration of certain concepts because of their closer similarities to man. The same guiding principle of respect for life in the use of animals for the welfare of man should apply in the study of all living objects, including the conservation of useful plants.

To guarantee that students acquire the spirit of humane treatment of animals, a qualified adult supervisor must assume primary responsibility for planning and conducting demonstrations involving intact living animals. Such supervision must extend to both classroom and extracurricular projects.

Proper quarters and care must be provided for the live creature at all times, including vacation periods. Students should be instructed in the principles of humane treatment of animals, and training in the proper handling of animals should be part of the preparation of all teachers who permit animals to remain in their classrooms for study.

The following principles for handling animals in the classroom must be observed:

1. A science teacher or other qualified adult supervisor must assume primary responsibility for the purposes and conditions of any study that involves live animals. If the school faculty does not include persons with training in the proper care of laboratory animals, the services of such a person should be sought on a consulting basis. Often a local veterinarian is pleased to offer this kind of help.

2. Each study involving animals should have as a clearly defined objective the teaching of some biological principle(s).

3. All animals used must be lawfully acquired in accordance with state and local laws.

4. The comfort of the animal used in any study should be a prime concern of the teacher and student investigator. Gentle handling, proper feeding and provision of sanitary quarters are among the basic needs that should be tended to.

5. No studies involving anesthetic drugs, surgical procedures, pathogenic organisms, toxicological product, carcinogens or radiation should be undertaken in the elementary classroom.

6. Any study involving pain should be avoided.

7. When animals are housed in school quarters over school vacation periods, adequate housing must be provided, and a qualified caretaker must be assigned the specific duties of care and feeding of the animal.

8. Teachers of students whose investigations go beyond regular class periods in school as part of a school assignment or project, such as a school science fair, must be assured that the principles stated above are observed.

Sample Guidelines for the Use of Animals in Science Projects or Science Fairs

The following regulations have been prepared by the International Science and Engineering Fair (ISEF) Guidelines to govern the use of animals in individual student research.

The legitimate use of animals in the classroom, in the laboratory or in science fair projects presupposes two postulates. First, that the use of animals for learning, as it is for testing and research, is morally acceptable; and second, that man has a responsibility to grant the animals he uses for his benefit every humane consideration for their comfort and well-being.

The moral responsibility we have toward animals means that we cannot give free rein to the students in projects involving animals. Consequently, those of us who would nurture a healthy curiosity in youngsters are placed in a delicate position. To "turn off" a prospective biologist or physician by excessive limitations would be a serious mistake. We know that through science fair work, thousands of today's physicians, dentists, veterinarians, scientists, engineers and science teachers were given an important impetus toward their careers.

The proper care and use of animals is a prime concern that cannot be ignored. If students can understand this concern, and if they can learn something about animals and their needs, they will gain a valuable personal lesson as well as further knowledge of biology.

Before proceeding with any phase of animal experimentation, a teacher's certification must be completed to ensure understanding and compliance with existing ISEF rules.

An animal care supervisor must be directly involved in every project, and primary responsibility for the animals must lie with this adult even though exceptional students may have developed the concern and knowledge necessary for the proper care and use of animals. A necessary part of some investigations may involve situations in which discomfort might be experienced by the experimental animals, but such experiments may only be undertaken when the learning experience justifies the procedure.

The teacher or adult supervisor must also be concerned with the choice of the experimental animal, which is an important element in an investigation. For most students, it is advisable to use lower forms of animals, since the basic similarities between organisms are probably greater than their differences, and much of the work that students might wish to do could be done as well with the lower forms of animal life.

The use of protista (unicell animals such as fungi, protozoa and algae) and other invertebrates is to be encouraged for most experiments involving animals. Their wide variety and the feasibility of using larger numbers than is usually possible with vertebrates makes them especially suitable.

This is not to say that the use of vertebrate animals should be prohibited. Certain forms of investigation can only be done with vertebrates. But since the higher forms of animal life are more complex, more experience and training are required to use them properly. Under proper supervision, there is no reason why students should not be permitted to use vertebrates in research.

All animals should be lawfully acquired, and their care and use must be in compliance with local, state and federal laws. Lack of availability of information about the proper care and use of animals is not an acceptable excuse. There are now available numerous publications, sources of information, and professionals who can supply information on proper care no matter how remote the school district.

Proper care is imperative since quality animal research demands quality animal care. If animals are not used or cared for properly, the accuracy of the data is certainly questionable, and the value of the project is thus greatly decreased and even destroyed. A student must have an adequate knowledge of the characteristics, care and handling of the species he or she is using in order to do good research.

Handling Laboratory Animals

A. Caution students and visitors about the danger of inserting fingers into an animal cage.

B. Biting or otherwise vicious animals should not be kept in elementary classrooms.

C. Handle rats, mice, guinea pigs and other animals gently so as not to excite them.

Animal Care

A. All animals used should be treated in a humane fashion. The animal care facilities should be kept clean and exemplary, vermin should be controlled, and wastes must be removed often and effectively. All feeding devices (water bottle in particular) should be cleaned often (daily if possible). Do likewise with bedding materials.

B. If you have a large number of animals, establish an Animal Care Center equipped with basic foods (KMR, Esbilac), vitamins, care library and file, and a bibliography with suggestions for housing animals for good health and adequate display purposes.

C. It is important to be aware of the hazards posed by live animals in the classroom and the means we have of controlling the dangers.

1. General Hazards

   a. Disease control is a prime concern, but other hazards must also be considered.

   b. Accidents such as falls due to wet slippery floors and cuts from improperly designed or poorly repaired cages may occur.

   c. Students' allergies to animals may also be a problem in the classroom.

2. Hazard Control

   a. Only healthy animals should be purchased from reliable sources. Infected animals can be a continuous low-level source of contamination to students.

   b. A veterinarian knowledgeable about laboratory animal care should be relied on to assist in your animal care and animal disease problems.

   c. Students should be allowed to take only heathly animals home.

Collecting and Preserving Insects

1. Students, either for science projects or for classroom study, often need to be familiar with the proper method for collecting and preserving insects. In collecting, students should be cautioned about allergies.

2. In preserving, a safe type of killing jar can be made by using any clean, large, screw-type lid jar (mayonnaise jars are quite acceptable). A tissue is placed in the bottom to serve as an absorber of the killing liquid. The killing liquid (such as ethyl alcohol) is added to the tissue in the bottom of the jar — about six drops is generally satisfactory. On top of the tissue containing the liquid, a clean tissue is placed to keep the insects dry. The jar must be labeled DANGER, POISONOUS FUMES, DO NOT BREATHE. It is a simple task to recharge the jar with lethal fumes by removing the top tissue and adding a few more drops of the killing liquid. A clean tissue is then replaced and the jar is again ready for use.

EXPERIMENTS CONDUCTED AT HOME AND SPECIAL PROJECTS

Teachers are encouraged to extend elementary science learning activities into the home. This requires that considerable instruction take place in the classroom prior to the home assignment. This instruction should include hands-on activities as well as other forms of classroom learning. It is important to do some of the experiments in school as well as at home to observe student behavior and to instruct students in proper procedures (including recording data). It is also important that sufficient instruction and guidance take place in school before the home assignment to ensure that students understand the relationship of the homework to previous classroom activities. Assignment of homework activities should never be a replacement for classroom activities.

The following procedures are suggested:

1. Teachers assigning experiments or projects to be conducted outside the classroom should discuss the experiments and projects with the principal or science supervisor prior to making the assignment.

2. Parents should also be advised that science activity homework will be assigned. Open House night is a good time to discuss this phase of the science program.

3. It is wise to send home a flyer outlining specific plans and parental involvement immediately prior to an assignment. If there are possible hazards, explain them. Ask the parent to sign and return the form.

4. Safety precautions should be discussed with the students prior to assigning experiments and projects.

5. Students should be instructed that certain activities are very hazardous and should be discouraged; i.e., setting fire to gasoline, storing or using gasoline or other flammable liquids inside the house, breaking fluorescent lamps and television picture tubes, and throwing aerosol cans and flashlight cells into a fire.

6. Since student interest often prompts further activites at home, students should be informed about home chemistry sets. They contain comparatively harmless chemicals and manuals accompanying them usually give complete direction for numerous experiments. No danger is likely as long as the directions are followed and the correct chemicals are used. Students should be cautioned not to pursue chemical experiments beyond the provided instructions. They should not mix chemicals to see what happens. Many common household chemicals can be dangerous in combination. Household ammonia, swimming pool chemicals, bleaching and dye preparation, lye, preparations for cleaning clogged drains, plant sprays, rat and insect poisons, disinfectants, chemicals in matches and fireworks, turpentine, paint removers, and some garden fertilizers can be mixed to produce hazardous products. For instance, the mixing of clorox and ammonia is particularly dangerous since toxic gases are produced.

FIELD TRIPS

Field trips should be educational and safe. It is not enough that they are fun and enjoyed, although these qualities should be present also. Field trips require planning and precautions. In most cases, forethought and common sense will prevent most accidents and harmful reactions.

The following items should be considered in planning:

1. Know the environment of the field trip and instruct the students on precautions, i.e., sharp rocks, thorns, eye-level branches, footing impairments, etc.

2. There are three highly allergic plants -- poison oak, poison sumac, and poison ivy. Know how to identify them and stay away from them.

3. Know your students. Do they have any specific allergies, i.e., grass, bee stings, pollen, etc.?

4. In the event of any accident or allergic reaction, try to make the student as comfortable as possible, but do not attempt to treat the student yourself. Get professional medical help as soon as possible.

5. Parents/guardians should be aware of the nature of the field trip and sign consent forms (see example on page 45). You should secure a phone number where they can be reached in an emergency. Doctors and hospital staff will not treat children unless parental/guardian consent is secured. The parental consent forms referred to earlier may not be enough.

6. Another good idea is a behavior contract for each parent and student to sign (see example on page 46). This contact can provide the incentive for students to take more seriously an occasion that appears to be fun and games.

7. Do not permit distractions that tend to interfer with student attention and provide no educational value, i.e., radios, head sets, recorders, etc.

8. Instruct students on proper apparel for the occasion, i.e., hiking shoes, old sneakers for swimming, a towel for working in water, long pants for brush country, a hat for hot and sunny weather, etc.

9. Call the newspaper or local radio station to get the most current weather forecast before departing.

10. Take along a first aid kit for superficial scratches and abrasions.

11. If on a bus trip, take along one automobile in the event you need to go to a hospital or first aid station, and know where these locations are.

12. Take along insect repellant, but before you use it on the students, make sure they do not have skin sensitivity that will produce a reaction.

It is the responsibility of the teacher in charge to provide a safe environment for the young students on science field trips. Of course scratches and wet feet may occur, and the teacher should be prepared for minor cuts, bee stings, etc. The environment and events of the trip should not, however, create fear in the students. More is lost than gained when this happens.

It is the responsibility of the student to take seriously the field trip and be responsible for his/her actions. This concept should be thoroughly understood before any such trips.

Field Trip Forms

Information about each trip or activity that takes a student away from the school should be shared with the student's parent(s) or guardian(s). Appropriate school personnel should also be informed. One vehicle for sharing information is the parent permission slip. The following format for the permission form is a generic one and can serve as a model that can be modified for any specific experience.

SAMPLE PERMISSION FORM

- SCHOOL NAME -

Teacher _____ Date _____

Dear Parent/Guardian:

A school trip for ____(purpose)____ will include students from grade ____ (grade level)____. The group will be led by Mr./Mrs./Ms. _____ (teacher)_____ on a trip to ____(location)____. While participating in this activity your son/daughter will be involved in educational activities which support and reinforce classroom instruction. Please sign this form and return it as an indication of your consent to your child's participation in this activity.

Thank you.

_____

(Classroom teacher)

****

Student's Name _____ Date _____

Parent/Guardian's Name _____

NOTE: Teachers may wish to attach or add additional information for the parents to this form.

Behavior Contracts

Each student should be aware of the behaviors that are expected and appropriate to the trip being planned. The following is a sample format that can serve as a model that can be adapted to your school code. The teacher should discuss appropriate behaviors with the students prior to the trip, and then inform parents of the expectations for students on the trip.

SAMPLE BEHAVIOR CONTRACT

- SCHOOL NAME -

Teacher _____ Date _____

Dear Parent/Guardian:

Student behavior on any trip is the responsibility of the student. The following are general guidelines which have been shared and discussed with your child. He/she is expected to:

- behave in an appropriate manner.
- follow the teacher's directions.
- follow safety directions from the teacher and other adults on trip.
- not collect samples of living plants and animals.
- avoid accidents and injury by not pushing, kicking or shoving others.

Please take time to review these behaviors with your child and have him/her return to me this contract signed below.

Thank you.

_____
(Classroom Teacher)

****

I understand the rules of behavior and my responsibility to follow them on this trip.

Student's Signature _____ Date _____

I have reviewed these rules and discussed them with my child.

Parent/Guardian's signature _____Date _____

ROCKETRY

Rocketry can be a safe, educational activity if the safety regulations set forth by the state are followed. In New Jersey, any individual using model rocket engines must have a permit from the Department of Labor, Office of Safety Compliance. Permits are not difficult to obtain and are renewable yearly. Currently, there is a fee of two dollars for a permit. Individuals interested in obtaining permits must apply to the Commissioner of Labor for the appropriate forms. Applicants will also receive a copy of safety regulations governing "Rocket Experimentation by Amateurs." Students must have their parents complete the application forms (with the parent's name, not the student's). The permit will be issued in the parent's name for the use of model rockets by a minor. Teachers who obtain a permit may supervise students in model rocketry activities.

These regulations are to prevent the "basement bomber" injuries that occur when individuals attempt to mix their own fuels. In contrast to such injuries, model rocketeers have launched over two million rockets with no rocket-caused injuries. Advanced modelers can gain considerable knowledge of aerodynamics, physics, mathematics, meteorology, electronics, optics and photography.

Applications for permits may be requested by phone (609) 292-1191 or in writing to:

Office of Safety Compliance
Department of Labor
36 West State Street
Room 300, CN 386
Trenton, New Jersey 08625-0386

The following guidelines pertain not only to launching a model rocket, but to its construction as well. If these basic guidelines are followed, model rocketry activities should be safe enough for general classroom use.

1. Any person using model rocket engines must be under the supervision of an adult who is at least 21 years of age and holds a permit issued by the Commissioner of Lafbor of the State of New Jersey.

2. Model rockets should weigh less than 16oz., their engines should contain less than 4 oz. of propellant at the time of launching, and they should be composed of no more than three stages.

3. Model rockets shall be constructed of paper, wood, plastic, rubber or similar materials and shall contain no substantial metal parts.

4. All rockets must contain a recovery system that will adequately retard descent so that no substantial damage will result to the rocket, and no danger will be created co persons or property.

5. Model rockets should contain no explosive warheads or pyrotechnic device.

6. Model rockets should not be flown as weapons against targets in the air or on the ground.

7. The stability of a rocket should be checked prior to launching so that its flight path can be predicted.

8. Model rockets should be flown in open areas away from buildings, power lines and major highways.

9. A remotely controlled and operated electrical safety sequenced firing system should be used to ignite and launch model rockets. This system must be fully under the control of the permit holder (see item 1) launching the rocket.

10. No rocket should be launched unless its construction is completed at least 24 hours before launch and all glue is completely dry.

11. Model rockets should be launched only during daylight hours except for valid educational scientific experiments.

12. Surface winds at the launch site should be less than 20 mph.

13. All model rockets should be inspected for defects prior to launching.

14. If it appears as though the engine has failed to ignite, wait for directions from the permit holder before approaching the rocket.

15. A launch angle of more than 60 degrees from the horizontal should be used.

16. When launching a rocket, all persons should stand at a safe distance from the launcher.

17. A minimum five-second countdown should be given prior to each launch to notify all persons in the immediate vicinity that a launching is imminent.

18. Model rockets share the air with other objects and should present no hazard to such objects. A careful visual check of the sky should be made prior to countdown for ignition to insure the absence of aircraft.

19. The design and construction should include attached surfaces which will provide aerodynamic stabilizing and restoring forces necessary to maintain a substantially true and predictable flight path.

20. Rocket engines must be solid propellent reaction engines, commercially manufactured so that all of the chemical ingredients of a combustible nature are pre-mixed and ready for use.

21. The force or motive power should be created by a rearward discharge of gas generated by the combustion or other operation of the materials contained solely within the device.

22. If the engine is constructed with the use of some metal, it should be equipped with a safety release to prevent rupture of the engine casing in the event of internal overpressure.

23. The engine must be designed and constructed to be incapable of spontaneous ignition or combustion in air, water and glycerin or under conditions of pressure, motion, jarring or a temperature of 170 degrees Farenheit.

24. The launch area should contain at least 5,000 square yards and should be generally rectangular in shape with no side less than 50 yards in length. The length of any side should not be less than the expected altitude of the rocket.

25. At time of launch a device should be used that will restrict the horizontal motion of the rocket until sufficient flight velocity has been attained for a reasonably safe and predictable flight.

26. At time of launch, visibility should be greater than one mile.

27. Students should not be allowed to alter model rocket engines or to reload engine casings.

A sample safety code for students follows.

SAMPLE MODEL ROCKETRY SAFETY CODE FOR STUDENTS

This safety code specifies precautions teachers and students should follow in executing the launch. The rules are mostly common sense, but they need to be emphasized with students.

1. Construction - My model rockets will be made of lightweight materials such as paper, wood, plastic, and rubber, without any metal as structural parts.

2. Engines - I will use only pre-loaded factory made model rocket engines in the manner recommended by the manufacturer. I will not change in any way nor attempt to reload these engines.

3. Recovery - I will always use a recovery system in my model rockets that will return them safely to the ground so that they may be flown again.

4. Weight Limits - My model rocket will weigh no more than 453 grams (16 ozs.) at liftoff, and the engines will contain no more than 113 grams (4 ozs.) of propellant.

5. Stability - I will check the stability of my model rockets before their first flight, except when launching models of already proven stability.

6. Launching System - The system I use to launch my model rockets must be remotely controlled and electrically operated and will contain a switch that will return to "off" when released. I will remain at least 10 feet away from any rocket that is being launched.

7. Launch Safety - I will not let anyone approach a model rocket on a launcher until I have made sure that either the safety interlock key has been removed or the battery has been disconnected from my launcher.

8. Flying Conditions - I will not launch my model rocket in high winds, near buildings, power lines, tall trees, low flying aircraft or under any conditions which might be dangerous to people or property.

9. Launch Area - My model rockets will always be launched from a cleared area, free of any easy-to-burn materials, and I will only use non-flammable wadding in my rockets.

10. Jet Deflector - My launcher will have a jet deflector device to prevent the engine exhaust from hitting the ground directly.

11. Launch Rod - To prevent accidental eye injury, I will always place the launcher so the end of the rod is above eye level or cap the end of the rod with my hand when approaching it. I will never place my head or body over the launching rod. When my launcher is not in use I will always store it so that the launch rod is not in an upright position.

12. Power Lines - I will never attempt to recover my rocket from a power line or other dangerous place.

13. Launch Targets and Angle - I will not launch rockets so their flight path will carry them against targets on the ground, and I will never use an explosive warhead nor a payload that is intended to be flammable. My launching device will always bo pointed with 30 degrees of vertical.

14. Pre-Launch Test - When conducting research activities with unproven designs or methods, I will, when possible, determine their reliability through pre-launch tests. I will conduct launchings of unproven designs in complete isolation from persons not participating in the actual launching.

VIEWING AN ECLIPSE

Looking directly at the intense sun, for even a short period of time, is dangerous and can cause permanent eye damage which may go undetected. The damage may be without pain and symptoms of damage may not appear for several days. It is often permanent damage because the eye retina is scorched, and scar tissue develops after healing.

The reason we are able to look directly at the sun during sunrise or sunset is not because it is less intense but because it is being seen through more layers of atmosphere at these times of day. The atmosphere contains water vapor and air pollution, which filter and reduce the intensity.

When we look at the sun, the eye's lens focuses the intense light on the retina, that delicate layer of cells at the back of the eye that sends visual images to the brain. Because the retina does not feel pain, we do not know when it is being burned. Damage occurs in viewing an eclipse at the very center of the field of vision. There is no treatment for a burned retina and no treatment for the scarring or the permanent blind spots.

There is no shield generally available that will protect your eyes from direct viewing of the sun. Dark sunglasses, light filters, exposed photographic film, welding goggles and smoked glass are ineffective. Looking at the eclipse through a camera viewfinder, a telescope or binoculars is especially dangerous since the lenses of these instruments can magnify and intensify the sun's light.

The safest method to enjoy the eclipse is to watch it on television, at professionally sponsored eclipse watches, or indirectly with the simple protection device described here.

Here's how to see the eclipse indirectly, safely and easily.*

1. Get two sheets of white cardboard.
2. Make a pinhole in the center of one of them.
3. Stand with the sun at your back.
4. With one sheet of cardboard in each hand, hold the sheet with the pinhole so that the sun shines through the hole onto the other sheet.
5. Adjust the sheets to focus the light. (You can change the size of the image by changing the distance between the sheets.)
6. Now, by looking at the bottom sheet, you can see an exact image of the sun and its eclipse. As the moon slowly crosses in front of the sun, you can see it all happen!

*Recommendations from the National Society to Prevent Blindness.

REFERENCES

General Resources:

These materials may be consulted for additional reading and information regarding safety issues in the science classroom.

Accident Prevention Manual for Industrial Operations. Seventh Edition. National Safety Council, Chicago, Illinois (1974).

Alrich Chemical Co. Catalogue. Aldrich Chemical Co., 940 W. St. Paul Ave., Milwaukee, Wisconsin 53233.

CRC Handbook of Laboratory Safety. Second Edition., Norman V. Steere, Ed. Chemical Rubber Co., Cleveland, Ohio.

Chemical and Biological Safety Guide. U.S. Department of Health, Education and Welfare, National Institutes of Health. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. Stock No. 184000383.

Fisher Safety Manual. Fisher Scientific Co., 771 Forbes Ave., Pittsburgh, PA. 15219.

Industrial Safety Data Sheets & Chemical Safety Guides. National Safety Council, Chicago, Illinois.

Laboratory Waste Disposal Manual. New edition available after January 1978. Manufacturing Chemists Association, 1825 Connecticut Ave., Washington, D.C. 20009.

MCB Chemical Reference Manual, Volume II. MCB Chemical Co., 2909 Highland Ave., Norwood, Ohio 45212.

Merck Index. Merck & Co., Inc., Rahway, N.J.

Registry of Toxic Effects of Chemical Substances. HEW Publication No. (NIOSH) 76-191. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Safety in the Academic Chemistry Laboratory. American Chemical Society, 1155 16th St., N.W., Washington, D.C. 18042.

Safety in the Chemical Laboratory. Norman V. Steere, Ed., reprints in 3 volumes. Division of Chemical Education, American Chemical Society, Easton, PA. 18042.

Other Useful References:

These materials may be consulted for additional reading in more specific areas of safety.

American National Safety Standard Practice for Occupational and Educational Eye and Face Protection. ANSI Z87.1-1968. American National Standards Institute, New York, N.Y. (1968)

Code of Federal Regulations, Title 29, Part 1910. "Occupational Safety and Health Standards." U.S. Occupational Safety and Health Administration. Superintendent of Documents. U.S. Government Printing Office, Washington, D.C. 20402

Communications for the Safety Professional. R.B. Konikow and F.E. McElroy: National Safety Council, Chicago, Illinois (1975)

Essentials of Toxicology. Second Edition. T.A. Loomis: Lea & Febiger, Philadelphia, Pennsylvania (1974)

Fundamentals of Industrial Hygiene. J.B. Olishifski and F.E. McElroy, Eds.: National Safety Council, Chicago, Illinois (1971)

Guide for Safety in the Chemical Laboratory. Second Edition. Manufacturing Chemists' Association: Van Nostrand Reinhold Company, New York, N.Y. (1972) (a portion of this is reproduced in the Laboratory Waste Disposal Manual listed under Basic References)

Hazardous Materials Handbook. Beverely Hills, California: Glencoe Press (1972)

The Industrial Environment - Its Evaluation and Control. National Institute for Occupational Safety and Health (NIOSH): U.S. Government Printing Office, Washington, D.C. (1973)

Industrial Ventilation: A Manual of Recommended Practice. Fourteenth Edition. American Conference of Governmental Industrial Hygienists: Committee on Industrial Ventilation, P.O. Box 16153, Lansing, Michigan 48901 (1976)

Lab Data. Quarterly. Underwriters Laboratories, Inc. 207 E. Ohio St., Chicago, Illinois 60611

Manual of Hazardous Chemical Reactions. NFPA No. 491M. National Fire Protection Association, Boston, Massachusetts (1975)

TLVs: Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes. American Conference of Governmental Industrial Hygienists: ACGIG, P.O. Box 1937, Cincinnati, Ohio 42501 (latest annual edition)

Additional Resources:

These organizations provide rental or sale films and filmstrips dealing with occupational safety and health.

Abbott Laboratories
Professional Relations Department
Abbott Park
North Chicago, IL 60064

Aetna Life & Casualty
151 Farmington Avenue
Hartford, CT 06115

American Gas Association
1515 Wilson Boulevard
Arlington, VA 22209

American Heart Association
Distribution Dept.
44 E. 23rd St.
New York, NY 10010

American Hospital Association
840 North Lake Shore Drive
Chicago, IL 60611

American Optical
Box 1
Southbridge, MA 01550

Area 16/Cinesound
915 N. Highlands
Hollywood, CA 90038

Association-Sterling Films
866 Third Avenue
New York, NY 10022
(Free Catalogs Available Upon Request)

The Atchison, Topeka & Santa Fe
Railway Co.
80 E. Jackson Blvd.
Chicago, IL 60604

Better Vision Institute
230 Park Avenue
New York, NY 10017

Bray Studios
630 Ninth Avenue
New York, NY 10036

The Bureau of Business Practices
24 Rope Ferry Rd.
Waterford, CT 06385

Close Productions, Inc.
2020 San Carlos Boulevard
Fort Myers Beach, FL 33931

Creative Communications, Inc.
13900 Panay Way
Marian del Rey, CA 90291

John V. Dunigan Studios
208-5th Avenue
New York, NY 10010
(Catalogue available)

Fisher Scientific Company
711 Forbes Avenue
Pittsburgh, PA 15219

Factory Mutual
1151 Boston-Providence Turnpike
Norwood, MA 02062
(Fire films only)

Federal Aviation Administration
P.O. Box 25082
Oklohoma City, OK 73125

Edward Feil Productions
1514 Prospect Avenue
Cleveland, Ohio 44115

The Fertilizer Institute
1015 - 18th St., NW
Washington, DC 20036

General Electric Educational Films
Corporations Park
Bldg. 705
Scotia, NY 12302

The Greater Chicago Safety Council
10 North Clark St.
Chicago, IL 60602

Greater Los Angeles Chapter
National Safety Council
3388 West 8th St.
Los Angeles, CA 90005

Harvest Films
309 Fifth Avenue
New York, NY 10016

Hyster Co.
P.O. Box 2902
Portland, OR 97208

Indiana University
Audio-Visual Center
Bloomington, IN 47401

International Film Bureau, Inc.
332 S. Michigan Avenue
Chicago, IL 60674

International Medifilms
3491 Cahuenga Boulevard
Los Angeles, CA 90068

Iowa State University
Fire Service Extension
Ames, IA 50010

Library Filmstrip Center
3033 Aloma
Wichita, Kansas 67211

J.F. Lincoln Arc Welding Foundation
P.O. Box 3035
Cleveland, Ohio 44117

Lineman's Supply Division
P.O. Box 1690
Binghamton, NY 13902

MacMillan Films
34 MacQuesten Parkway, South
Mount Vernon, NY 10550

Manufacturing Chemist Assn.
1825 Connecticut Avenue, NW
Washington, DC 20009

Marshall Maintenance
529 South Clinton Avenue
Trenton, NJ 08611

Middle West Service Co.
69 Washington St.
Chicago, IL 60602

Mogull's
235 W. 46th St.
New York, NY 10010

National Educational Media, Inc.
15250 Ventura Blvd.
Sherman Oaks, CA 91403

The National Film Board of Canada
1251 Avenue of the Americas
New York, NY 10020
(Address for catalogue only)

National Restaurant Association
One IBM Plaza
Suite 2600
Chicago, IL 60611

National Rural Electric Cooperative
2000 Florida Avenue, NW
Retirement Safety & Insurance Dept.
Washington, DC 20009

National Society to Prevent
Blindness
79 Madison Avenue
New York, NY 10016

National Safety Council
425 N. Michigan Avenue
Chicago, IL 60611

New England Health Resource Center
Dept. of Media Services
University of New Hampshire
Durham, HH 03824

New York State College of
Agriculture & Life Science
Cornell University
Roberts Hall - Film Library
Ithaca, NY 14850

The Ohio State University
Film Library
Dept. of Photography & Cinema
156 W. 19th Avenue
Columbus, OH 43210

The Pennsylvania State University
Audio-Visual Service
176 Willard Building
University Park, PA 16802

Scott Education
Customer Service
104 Lower Westfield Rd.
Holyoke, MA 01040

Southern Pacific Transporatation
Company
Audio-Visual Center
475 Brannan St.
San Francisco, CA 94107

U.S. Dept. of Agriculture
Office of Communication
Washington, DC 20250

Universal Education & Visual Arts
100 Universal City Plaza
Universal City, CA 91608

University of Kansas
Audio-Visual Center
746 Massachusetts St.
Lawrence, KN 66044

University of Michigan
Audio-Visual Education Center
416 Fourth St.
Ann Arbor, MI 48103

Visual Education, Inc.
1425 H. St., NW
Suite 424 - Southern Bldg.
Washington, DC 20005

Wilson Products Division
P.O. Box 622
Reading, PA 19603

Xerox Films
245 Long Hill Rd.
Middletown, CT 06457

Eye Protection In Educational Institutions
N.J. State Department of Education
Division of Vocational Education

Occupational Safety And Health Administration (OSHA)
U.S. Department of Labor OSHA

Belle Mead GSA Depot Bldg. T-3 Belle Mead, N.J. 08502 201-395-2777	Hunterdon, Middlesex, Somerset, Union & Warren
2101 Ferry Avenue, Suite 403 Camden, N.J. 08104	Atlantic, Burlington, Camden, Cape May Cumberland, Mercer, Monmouth, Ocean & Salem
2 East Blackwell Street Dover, N.J. 07801 201-316-4050	Essex, Hudson, Morris & Sussex
377 Route 17, Room 206 Hasbrouck Heights, N.J. 07604 201-288-17--	Bergen, Passaic

2374j

Elementary Science Safety Manual

FEEDBACK FORM

The Department of Education would appreciate your feedback after you have used this manual. Your response will be most welcome. Please make a photocopy of this page and return it to the below address.

1. What is your position? Grade Level

   _____ Principal _____ Teacher _____ Other (Specify) _____
   _____ Grade K-8 _____ Grade 9-12 _____ Other (Specify) _____

2. From whom did you receive this manual?

   ___ Principal ___ Teacher ___Curriculum Coordinator ___ Other

3. How much helpful information is provided by this manual?

   ___ Much ___ Some ___ Little ___ None

   What are the two most useful items you have found?

   a. _____

   b. _____

4. Is the manual easy to read and understand? ___ Yes ___ No

5. What are possible student outcomes that could result from the use of this manual?

   a. _____

   b. _____

6. Will you use it in the future? ___ Yes ___ No

7. What other information should be added to this manual?

   _____

8. Other comments.

   _____

   _____

Please return this form to:

Cognitive Skills Unit/GAE
New Jersey State Department of Education
CN 500
225 West State Street
Trenton, New Jersey 08625

OPTIONAL: Name _____ Tel. _____

BM/mh:1/2074j